

Application No. 09/989,024
Supplemental Reply to Office Action of May 8, 2003

Amendments to the Claims:

This listing of claims will replace all prior versions, and listing of, claims in the application.

Listing of Claims:

Claim 1 (Currently Amended): A method for manufacturing a nano-tube comprising the steps of:

arranging a first electrode and a second electrode to be opposite to each other, said second electrode being made of a material ~~mainly~~ including a carbon material;

applying a voltage between said first electrode and said second electrode to carry out arc discharge for a period of three seconds or less between said first electrode and predetermined regions of said second electrode; and

~~subjecting~~ treating the carbon material on said predetermined regions of said second electrode to the arc discharge so as to transform the carbon material on said predetermined regions of said second electrode into the nano-tubes on a surface of said second substrate at said predetermined regions due to said arc discharge.

Claim 2 (Currently Amended): The method as defined in claim 1, wherein said first electrode ~~comprises a torch electrode provided at an arc torch; and~~

said step of ~~subjecting~~ treating said carbon material on said predetermined region of said second electrode ~~to transform into said nano-tube on a surface of said second substrate at said predetermined regions due to said arc discharge~~ is carried out while moving said a torch electrode provided at an arc torch of the first electrode and second electrode relatively to each other.

predetermined regions of said second electrode
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Claim 3 (Currently Amended): The method as defined in claim 1 or 2, wherein said second electrode is arranged on a surface of a substrate; and

said step of ~~subjecting~~ treating said carbon material on said predetermined region of said second electrode to ~~transform into said nano-tube on a surface of said second substrate at said predetermined regions due to said arc discharge~~ is carried out while said substrate is positioned on a cooling member to cool said substrate through said cooling member.

Claim 4 (Currently Amended): The method as defined in claim 1 or 2, wherein said step of ~~subjecting~~ treating said carbon material on said predetermined region of said second electrode to ~~transform into said nano-tube on a surface of said second substrate at said predetermined regions due to said arc discharge~~ is carried out while at least said first electrode, said second electrode and an arc discharge region between said first electrode and said second electrode is surrounded with a surrounding member.

Claim 5 (Previously Presented): The method as defined in claim 1 or 2, wherein said carbon material for said second electrode is any one selected from the group consisting of graphite, carbon, activated carbon, amorphous carbon and graphite.

Claim 6 (Previously Presented): The method as defined in claim 1 or 2, wherein said carbon material for said second electrode is any one selected from the group consisting of a carbon material containing a metal catalyst, that having a metal catalyst formed on a surface thereof, that containing B and a metal catalyst, that having B formed on a surface thereof and that having B and a metal catalyst formed on a surface thereof.

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Claim 7 (Previously Presented): The method as defined in claim 6, wherein said metal catalyst is selected from the group consisting of Li, B, Mg, Al, Si, P, S, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Y, Zr, Nb, Mo, Rh, Pd, In, Sn, Sb, La, Hf, Ta, W, Os, Pt, an oxide thereof, a nitride thereof, a carbide thereof, a sulfide thereof, a chloride thereof, a sulfate thereof, a nitrate thereof and a mixture thereof.

Claim 8 (Previously Presented): The method as defined in any one of claims 1 and 2, wherein said arc discharge is carried out while feeding a specific gas to a region in which said arc discharge is generated.

Claim 9 (Currently Amended): The method as defined in claim 8, wherein said specific gas is selected from the group consisting of ~~rare gas including~~ Ar, and He, air, nitrogen gas, carbon dioxide gas, oxygen gas, hydrogen gas and a mixture thereof.

Claim 10 (Currently Amended): The method as defined in claim 1 or 2, wherein said first electrode is made of a material ~~mainly~~ including graphite, activated carbon and amorphous carbon.

Claim 11 (Previously Presented): The method as defined in claim 1 or 2, wherein said arc discharge is generated by a DC or a DC pulse; and
said second electrode acts as an anode for said arc discharge.

Claim 12 (Previously Presented): The method as defined in claim 1 or 2, wherein said arc discharge is generated by an AC or an AC pulse.

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Claim 13-17 (Canceled):

Claim 18 (Currently Amended): A method for patterning a nano-tube, comprising the steps of:

~~arranging~~ providing a first electrode and a second electrode to be opposite to each other, said second electrode being made of a material ~~mainly~~ including a carbon material;

applying a voltage between said first electrode and said second electrode to generate arc discharge for a period of three seconds or less between said first electrode and predetermined regions of said second electrode; and

~~subjecting~~ ~~treating~~ the carbon material on said predetermined regions of said second electrode to the arc discharge so as to transform the carbon material on said predetermined regions of said second electrode into the nano-tubes on a surface of said second substrate at said predetermined regions due to said arc discharge while moving a torch electrode provided at an arc torch of said first electrode and second electrode relatively to each other.

Claim 19 (Currently Amended): A method for patterning a nano-tube, comprising the steps of:

~~arranging~~ providing a first electrode and a second electrode to be opposite each other, said second electrode being made of a material ~~mainly~~ including a carbon material having a predetermined metal catalyst pattern;

applying a voltage between said first electrode and second electrode to generate arc discharge for a period of three seconds or less between said first electrode and predetermined regions of said second electrode; and

~~subjecting~~ ~~treating~~ the carbon material on said predetermined regions of said second electrode to the arc discharge so as to transform the carbon material on said predetermined

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regions of said second electrode into the nano-tubes on a surface of said second substrate at said predetermined regions due to said arc discharge.

Claim 20 (Currently Amended): A method for patterning a nano-tube, comprising the steps of:

arranging providing a first electrode and a second electrode to be opposite to each other, said second electrode being made of a material including a carbon material;

arranging providing a mask of any having openings pattern to be, said mask separated from and above a surface of said second electrode;

applying a voltage between said first electrode and said second electrode to generate arc discharge for a period of three seconds or less between said first electrode and predetermined regions of said second electrode; and

subjecting treating the carbon material on said predetermined regions of said second electrode to the arc discharge so as to transform the carbon material on said predetermined regions of said second electrode into the nano-tubes on a surface of said second substrate at said predetermined regions due to said arc discharge.

Claim 21 (Previously Presented): The method as defined in any one of claims 18 and 20, wherein said first electrode comprises a torch electrode provided at an arc torch.

Claims 22-23 (Canceled);

Claim 24 (Previously Presented): The method as defined in claim 19, wherein said carbon material contains a metal catalyst.

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Claim 25 (Previously Presented): The method as defined in claim 24, wherein said metal catalyst is formed on a surface of said carbon material.